PHSX 566: Mathematical Physics I  
Fall, 2015  
**Instructor:** Charles Kankelborg  
**Text:** *Mathematical Methods for Physics and Engineering*  
by Riley, Hobson and Bence (Cambridge, 3rd ed.)  
**Lectures:** MWF 12:00-12:50 am, AJM Johnson 238  
**Office:** EPS 260C, x7853  
**Office hours:** Per posted schedule, or by appointment  
**Grader:** Nick Loutrel

**Description**

In this course, we will encounter a selection of mathematical methods applicable to physics. A common synonym is theoretical physics, but I am primarily an experimentalist. It should not surprise you that mathematical physics is essential to experiment design and data analysis. The character of the text is more practical than formal, and it is quite readable.

We will not cover the entire text in one semester. Instead we will focus on a short list of topics, explore their connections, and spend enough time in each area to develop confidence.

**Grading**

Homework assignments, worth 10 points each, will be due in class every week. Late homework will be assessed a 1 point penalty per day. The remainder of the grade will be determined by the midterm and final exams, worth 50 and 100 points, respectively. The midterm will be in class, date TBD. The final exam is scheduled for *Tuesday, December 8, 2015, 4:00-5:50 am in our classroom.*

**Useful references**

The following materials will be placed on reserve in the Library.

- Bracewell, *The Fourier Transform and its Applications*
- Gradshteyn & Ryzhik, *Table of Integrals, Series, and Products*

In addition, the following is available electronically:

- Abramowitz & Stegun, *Handbook of Mathematical Functions*,  
Course Outline
The following list of topics is tentative.

1. Fourier and Laplace transforms (ch. 13)
2. Green’s function solution of ODEs (§15.2)
3. Eigenfunction approach to ODEs (ch. 17)
   (a) Dirac notation, orthonormal bases, Hermitian operators (§§17.0-17.3)
   (b) Green’s functions (§17.5)
   (c) Sturm-Liouville equations and special functions (§17.4)
4. Partial Differential Equations (chs. 20-21)
   (a) Common physics PDEs (§20.1)
   (b) Separation of variables, special functions (§§21.1-21.3)
   (c) Integral transform methods (§21.4)
   (d) Eigenfunctions and propagators (not in text)
   (e) Green’s functions for inhomogeneous PDEs (§21.5)
5. Complex analysis (ch. 24)
   (a) Analytic functions (SS24.1-24.6)
   (b) Integrals and residue theory (SS24.8-24.13)
6. Special topic—time permitting